The Veterinary Record

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888.

No. 52. DECEMBER 30, 1939. VOL. 51.

The Control of Sheep Ticks

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I.—Preventing Infestation of Ewes and Lambs

It has already been reported that, in theory at least, various methods can be used to destroy sheep ticks, but of these only one or two possess much value under practical sheep farming conditions. Systematic sheep dipping during the active tick season is an important control measure, and in this connection it is necessary to distinguish between dipping fluids which kill ticks at the time of immersion, and improved dips which in addition retain their tick-destroying activity for a varying period after the dip has dried on the fleece. For the sake of brevity these latter dips are described as tick-deterrent dips. Experiments have already been described in this journal which showed that sheep dips compounded with derris root but not containing arsenic possessed, under the conditions of the tests, little or no tick-deterrent properties although they were good killers. MacLeod has suggested that much better protection may be obtained with plain derris dips when the immersion time is increased to 30 seconds or more, but where large numbers of sheep are being dipped it is difficult in practice to enforce this. On the other hand dips containing arsenic and wool grease in addition to derris root give reasonable protection from ticks for at least two weeks after an immersion period of 15 seconds, which is the usual dipping rate in actual farm practice.

Another interesting finding was the discovery in 1938 that a preparation of powdered derris root shaken on to newly born lambs in the form of a fine dust prevented tick infestation for a surprisingly long period. It is difficult to account for this in view of the less satisfactory results already obtained with plain derris dips, but the explanation probably lies in the fact that a higher concentration of derris is retained by the skin and fleece as compared with the same substance used as a dip.

In 1939 these experiments were continued and extended, special attention being paid to dips containing arsenic, derris root and wool grease, and also to the use of derris dust on ewes as well as lambs. Further information was also obtained on the inter-relationship between tick infestation and the occurrence of tick-borne diseases. A preliminary test was carried out on two adjacent sections of a tick-infested farm to compare the relative efficiencies of dipping and dusting. Fourteen ewes on each hill, obtained by leaving every sixth ewe on a sub-section untreated, served as controls. Three ewes on each section were dusted with derris powder instead of being dipped. Comparative tick counts were made at weekly intervals. All lambs born, except the lambs belonging to the untreated control ewes, were dusted at birth with derris powder. The first dipping took place on April 12th, just before the commencement of lambing.

RESULTS.

Table I.

Average Tick Counts—Ewes

	Date.	Hill 1 (Dip A).			Hill 2 (Dip B).		
		Untreated Control Ewes.	Dipped Ewes.	Dusted Ewes.	Untreated Control Ewes.	Dipped Ewes.	Dusted Ewes.
Before dipping ...	Apr. 12	39	39	39	28	28	28
After dipping ...	„ 19	90	6	5	80	8	5
	„ 26	59	18	12	57	17	4
	May 3	38	30	21	45	27	12

It will be seen that the dips provided useful protection from ticks for about two weeks, whilst on both hills fewer ticks were present on the dusted than on the dipped ewes. In order to confirm this observation by dusting a larger number of ewes a section on each hill carrying about 100 ewes was equally divided—one half being dipped in the usual way, whilst the other half was dusted with derris powder. The 14 original untreated ewes were again utilised as controls. Tick counts were conducted weekly.

These trials therefore show that when tested under identical conditions powdered derris root prevented tick infestation more effectively than the best dipping solution yet tried. Moreover, the application of an effective tick-destroying agent in the form of a dry dust appears to have distinct advantages over immersion in a dipping bath. For example, sheep can be dusted on their own section of the hill (heft), thus avoiding driving them long distances to the dipping folds. Again, dusting avoids the shock of immersion in cold water at a time when the ewes are heavy in lamb, a procedure which few sheep farmers would voluntarily adopt a month prior to lambing. On the other hand

Results.

Table II.

Hill 1. Average Tick counts on Dipped, Dusted and Control Sheep. (Dipping and Dusting, May 4th.).

Seven Days after Treatment.			Fourteen Days after Treatment.			Twenty-one Days after Treatment.		
Controls.	Dipped.	Dusted.	Controls.	Dipped.	Dusted.	Controls.	Dipped.	Dusted.
17	2	3	9	13	2	5	2	3
33	1	1	7	6	1	5	1	2
30	5	0	25	2	3	5	3	0
19	4	0	10	4	0	6	2	1
28	17	0	13	18	0	4	0	3
35	0	2	13	7	3	7	1	0
8	4	2	0	4	6	7	2	0
20	6	2	7	1	4	7	0	1
9	1	0	8	3	4	3	3	2
28	4	1	3	7	0	8	1	1
	11	1						
		6						
		4						
		6						
Average 22·7	5·0	2·0	9·5	6·5	2·3	5·7	1·5	1·3

Table III.

Hill 2. Tick Counts on Dipped, Dusted and Control Sheep. (Dipped and Dusted, May 16th, 1939.)

Seven Days after Treatment.			Fourteen Days after Treatment.			Twenty-one Days after Treatment.		
Controls.	Dipped.	Dusted.	Controls.	Dipped.	Dusted.	Controls.	Dipped.	Dusted.
26	0	0	11	1	1	7	2	0
43	1	0	13	8	0	4	0	0
74	0	0	46	2	1	10	1	0
18	3	0	16	5	1	9	8	1
52	1	0	22	6	0	14	4	1
47	2	0	10	4	1	4	2	2
27	0	0	5	2	0	2	2	0
16	12	3	16	2	0	8	5	0
17	3	0	9	1		0	4	1
19	1	0	13	6		5	4	1
		0						
		0						
Average 34	2·3	0·3	16·1	3·7	0·5	6·3	3·2	0·5

The figures for the controls show that the active tick season was waning during the period of experiment.

dipping is considered safe and is largely practised a day or two before lambing commences, *i.e.*, mid-April. Ticks normally become active early in March, and thus by employing a dust instead of a dip ticks can be prevented from enjoying about six weeks' uninterrupted development. A proprietary brand of derris root supplied by the Cooper Technical Bureau was used. The powder was shaken from a sprinkler-top tin, and rubbed with the fingers along the sheep's ventral surface, special attention being paid to axillae, head, neck, ears and chin. The powder is irritating to mucous surfaces and special care is necessary to prevent the dust entering the sheep's nostrils and eyes. After the first dusting several sheep developed ophthalmia, but this trouble was prevented in subsequent dustings by pressing the ear over the eye whilst powdering the head and allowing each sheep to leave the pen immediately after treatment.

Lambs

On Hill 1 an examination of dusted and control lambs was made on May 3rd. These lambs were dusted at birth and ranged up to 17 days old. The tick counts were as follows:—

Dusted lambs: 0, 1, 9, 0, 0, 0, 2, 0, 1. Average 1·5.

Control lambs: 7, 10, 13, 10, 46, 12, 13, 5, 13, 9, 4. Average 13.

The lambs on Hill 1 (except controls) were given a second dusting on May 11th. Comparative counts were made on May 23rd and May 30th.

After 12 days:—

Dusted lambs: 3, 2, 2, 2, 1, 1, 2, 1, 0, 0. Average 1·4.

Control lambs: 9, 8, 11, 2, 9, 13, 10, 8, 6. Average 8·4.

After 19 days:—

Dusted lambs: 0, 2, 4, 3, 0, 6, 2, 2, 4, 4. Average 2·7.

Control lambs: 6, 6, 3, 4, 10, 6, 8, 6, 7, 5. Average 6·1.

Similar results were obtained from lambs on Hill 2. The first examination was made on May 2nd, when lambs ranged in age up to 17 days.

Dusted lambs: 9, 8, 0. Average 6.

Control lambs: 10, 9, 24, 7, 8, 23. Average 13.

These lambs were again dusted (except controls) on May 16th. Comparative counts were made on May 23rd and May 30th.

After 7 days:—

Dusted lambs: 2, 0, 0, 2, 0, 0, 1, 0, 1, 0, 0, 0. Average 0·5.

Control lambs: 8, 11, 13, 8, 8, 9, 11, 11. Average 10.

After 14 days:—

Dusted lambs: 0, 1, 0, 3, 1, 4, 1, 1, 2, 1. Average 1·4.

Control lambs: 8, 7, 10, 6, 6, 8, 10, 5. Average 7.

Thus comparative tick counts on lambs treated with derris powder and untreated lambs, carried out at 7, 12, 14 and 19 days after treatment, confirmed the previous view that derris powder is of great value in preventing tick infestation of lambs.

Effect of Tick Control Measures on Lamb Mortality

Observations on lamb mortality and measures for tick control were instituted in April, 1937. Lambs were dusted in 1938 and 1939. Despite dusting, 62 lambs died in 1938, but part of this loss was due to lamb dysentery which killed 30 lambs before being brought under control. The lamb crop in 1939 constituted a record for this farm (708 lambs from 787 ewes). It is believed that the discovery of an effective and convenient method of reducing tick infestation in lambs has contributed in large measure to this result.

Table IV

Showing Lamb Crop and Death-Rates over Eight Years of Ewes and Lambs.

Autumn of—	No. of Ewes.	Spring of—	Ewe Deaths.	Barren Ewes.	No. of Ewes with Lambs May 13th.	Lambs alive June 15th.	Lamb Deaths May 13th—June 15th.
1931	863	1932	—	154	700	628	72
1932	831	1933	10	121	700	612	88
1933	821	1934	17	84	720	643	77
1934	821	1935	13	101	707	619	88
1935	824	1936	19	91	714	584	130
1936	837	1937	29	97	711	617	94
1937	814	1938	6	72	736	674	62
1938	799	1939	12	58	729	708	21

II.—Tick-borne Diseases

In tick-infested areas great stress is laid on what is termed the "acclimatisation" of hill sheep to a particular grazing, and there is a widespread belief, arising from practical experience, that much loss will follow the introduction of non-acclimatised sheep to tick-infested pastures. It was, therefore, with some misgivings that it was decided to move unacclimatised tick-free sheep to a ticky farm during the active tick season in order to observe accurately the subsequent behaviour of these animals. Twenty-one Blackface ewes, each with a single lamb seven to ten days old at foot, were transferred to a tick-infested farm on May 9th. All the sheep were numbered and lambs were treated prophylactically against pulpy-kidney disease. Upon arrival seven ewes and their lambs were dusted with powdered derris root, and dusting was repeated at weekly intervals in an attempt to maintain this group entirely free from ticks. The remaining 14 ewes and their lambs were not dusted, and the entire 42 unacclimatised sheep were pastured together in an enclosure known to be tick infested. Unfortunately, the group could not be kept on the worst tick land owing to lack of fencing.

The body temperatures of all ewes and lambs were recorded daily for four weeks, and a constant watch was kept for the presence of ticks. Many high temperatures (above 106° F.) were charted and various drugs were administered in an attempt to curtail the febrile phase.

Results.

The seven dusted lambs were examined daily and not once during the four weeks of observation were adult, nymphal or larval ticks found attached to the skin. The undusted lambs had an average of three adult ticks on the second day and nine ticks on the fourth day. Not one of the dusted lambs developed a temperature as high as 106° F., whereas eleven undusted lambs showed high temperatures (106° F. or higher) during this period. It was concluded therefore that weekly dusting with derris powder protected young lambs completely from tick infestation, and indirectly prevented the temperature reactions which are regarded as evidence of tick-borne infections.

Of the dusted ewes six out of seven picked up a few larval and nymphal ticks six days after dusting, but these disappeared after re-dusting on the seventh day. A week later a few larvae were again noted on two ewes prior to the third dusting, but no more ticks were observed to be attached while observations were continued. The undusted ewes all showed moderate tick infestations, an average of 23 adult ticks being found after five days. Thereafter ticks were less numerous, due to the seasonal decline in tick population, the weekly averages being 16 and 10. Four of the seven dusted ewes developed temperatures higher than 106° F., as did all 14 undusted ewes in the same period. Fever developed on the average eight days after exposure to ticks in the case of ewes and 13 days in the case of lambs. If this febrile phase be regarded as indicative of the existence of tick-borne infection this experiment clearly proved that "unacclimatised" sheep are highly susceptible, and that a high proportion (100 per cent. in this experiment) contract infection soon after being moved to ticky land. In addition, the tick counts on the dusted ewes show that the infection can be transmitted by as few as one or two nymphal ticks. (The bite of the larval tick is considered innocuous.)

Blood films were made from all sheep and lambs showing elevated temperatures, and the Rickettsia-like bodies of "tick-borne" fever were observed in the leucocytes of all sheep and lambs thus examined (except in the case of one ewe and one lamb). Thus, it seems clear that the pyrexia and dejection commonly noted in sheep recently moved to tick-infested pastures is associated with this specific ailment. It is to be noted, however, that none of these ewes and lambs was observed to be acutely ill and many appeared normal. One ewe died from louping-ill, and one lamb died from an acute inflammatory condition. Three undusted lambs became slightly lame but showed no external lesions. The dusted lambs remained perfectly healthy throughout.

The action of certain drugs was tested on a number of lambs showing high temperatures. Uleron (Bayer) was administered in 1 gramme doses on six consecutive days to four lambs. Acapron (Bayer) was injected subcutaneously on four successive days to three lambs. Adequate untreated controls were left. Acapron had no effect but Uleron appeared to reduce the body temperature considerably after two treatments. The average temperature of the eleven lambs before treatment was 106·5° F. After receiving two doses of Uleron four lambs had an average temperature of 103·4° F. whereas the remaining seven averaged 105·3° F. (See Table V.) Further experimentation with larger numbers of lambs would appear to be necessary. Acapron and Prontosil (Bayer) were administered to ewes and in this test Prontosil given to six ewes in 10 gramme doses daily for ten days appeared to bring the temperature below the 106·0° F. level after one treatment. After two treatments there was a considerable difference between the temperatures of the six ewes receiving Prontosil (average 103·1° F.) and that of the other twelve ewes (average 106·0° F.). Moreover, in the case of the controls and the ewes dosed with Acapron the high temperature was maintained for several days

(average five days but several as many as seven, eight, nine and ten days) whereas after the temperatures of the prontosil group had been brought down in one day they did not rise again throughout the ten-day period of treatment. A summary of the chemotherapeutic results obtained is given in Table V.

Table V.

Effect of Drugs on Body Temperature.

Treatment.	No. of Cases.	Temperature before Treatment.	Temperature after 1 Day's Treatment.	Temperature after 2 Day's Treatment.
(*a*) Lambs				
Control	4	106·5	106·3	106·5
		107·2	106·3	*91·0
		106·5	106·2	104·5
		106·3	105·4	104·0
	Average	**106·6**	**106·0**	**105·0**
Uleron	4	106·6	105·8	104·2
		106·0	104·9	103·6
		106·7	103·9	102·2
		106·4	105·9	103·5
	Average	**106·4**	**105·1**	**103·4**
Acapron	3	106·1	106·6	107·0
		107·0	106·9	†106·0
		106·2	105·1	103·7
	Average	**106·4**	**106·2**	**105·6**
(*b*) Ewes				
Control	6	106·2	105·2	106·2
		106·1	106·4	105·3
		106·1	106·6	106·7
		107·2	105·1	106·6
		107·1	106·4	105·3
		106·1	107·6	106·7
	Average	**106·5**	**106·2**	**106·1**
Prontosil	6	106·0	104·2	103·4
		108·0	106·0	101·1
		107·4	104·3	103·4
		107·4	107·2	104·6
		107·3	104·2	102·7
		107·2	105·3	103·3
	Average	**107·2**	**105·2**	**103·1**
Acapron	6	106·6	107·4	106·0
		106·6	107·4	106·0
		107·0	106·4	‡105·1
		107·7	106·7	106·2
		107·9	106·3	105·8
		106·5	106·3	106·4
	Average	**107·0**	**106·7**	**105·9**

* Died the same day of L.D. Not included in average
† Died 11 days later after a second bout of fever.
‡ Died 15 days later after two further bouts of fever.

CONCLUSIONS

(1) A preparation containing powdered derris root was applied to two groups of ewes on a tick-infested farm as an alternative to dipping. The powder proved to be more effective in keeping the ewes tick-free than the best dipping solutions yet tried.

(2) Derris powder is a convenient and effective treatment for preventing tick infestation in young lambs.

(3) The lamb mortality on one tick-infested farm has been greatly reduced by applying control measures (dipping and dusting).

(4) Twenty-five out of 28 unacclimatised sheep not protected from ticks developed temperatures above 106° F., whereas in 14 similar sheep protected from tick bites by derris powder, only four developed febrile reactions. The drugs known as Uleron (Bayer) and Prontosil (Bayer) appeared to shorten the febrile phase.

The dipping and dusting experiments were carried out with the assistance of a grant from the Royal Agricultural Society of England. The work on tick-borne diseases was assisted by a grant from the Agricultural Research Council.

Twenty-One Years of Progress and Its Value in War-Time

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The interval of peace from 1918 to 1939 has been one of unprecedented progress in the field of animal disease research, and in many directions these researches have culminated in practical methods of controlling disease. During this period a large number of therapeutic agents have been evolved which have been proved by experiment and by practical experience to be effective. It is probable that while the war lasts fewer opportunities will be afforded of carrying out fundamental research and our duty resolves itself into an effort to apply the discoveries of peace-time to conserve our live-stock in time of war. As a preliminary to our efforts, it would benefit us all to review this past progress and to survey the methods we now have at our disposal for the control of animal diseases.

Prolonged and arduous investigations have been conducted into the aetiology of bovine mastitis. These have resulted in the conclusion that the prevailing form of the disease, chronic streptococcal mastitis, can be controlled by systematic bacteriological examination of milk. Later work has shown that a large proportion of infected animals will respond to treatment by udder infusion with acriflavine, and there is evidence that sulphanilamide given in large doses by the mouth may be effective. Evidence has accumulated to show that contagious abortion can be eradicated from dairy herds by applying the agglutination test. There is a better understanding of the principles of vaccination and it has been established that a useful degree of immunity to *Brucella abortus*

can be stimulated by inoculation with an avirulent strain, thus holding out hope that herds may be protected without committing the owner to a permanent state of infection owing to the use of a live vaccine containing virulent organisms. Calfhood vaccination has given promising results in the United States and later in Denmark, and we have prospects of being able to vaccinate and eradicate in the same herd and at the same time. The control of tuberculosis has been facilitated by the development of a tuberculin prepared with a synthetic medium. Blackleg vaccination has passed from the stage where standardisation was haphazard, and formalin-killed vaccine is available with its advantages of being free from live organisms, and capable of standardisation.

Of all our farm animals the sheep has probably benefited most from the progress of the last 20 years. Diseases affecting sheep of all ages have been investigated and success has been the almost invariable conclusion. Many farms in Scotland and the north of England were at one time in imminent danger of being abandoned for sheep rearing because of increasing losses caused by lamb dysentery. At a time when the disease appeared to be increasing in its severity, and when foci of infection were appearing in other parts of Great Britain, the causal organism of the disease was identified, and this was soon followed by conclusive evidence that the disease could be prevented by a specific anti-serum. The investigators carried their work still further and proved that if the ewe were actively immunised, the lamb would derive sufficient antibody from the colostrum to afford it protection during the vital period of 48 hours following its birth. This discovery conferred great benefits upon flocks which grazed in inaccessible pastures on which lambs could not receive serum injections in time. A few years later, investigations in Great Britain and in the Dominions revealed that certain diseases of older lambs and of adult sheep were caused by organisms closely related to, but immunologically distinct from, the lamb dysentery organism. Our knowledge of these diseases accumulated rapidly and the two diseases, entero-toxaemia and pulpy kidney disease, became well-defined entities. This was rapidly followed by field experiments with vaccine and sera, with general though not universal success. Experimental vaccination against entero-toxaemia of adult ewes has been generally successful, but field experiments with serum in the control of pulpy kidney disease generally have been vitiated by a low incidence of the disease in control uninoculated lambs. There is, however, sufficient evidence, both experimental and clinical, to justify the employment of serum and vaccine therapy, and to anticipate control over the diseases. An intensive investigation in Scotland led to the complete elucidation of the aetiology of louping-ill, and incidentally, brought to light a hitherto unrecognised disease, tick-borne fever. The investigations proved conclusively that louping-ill was caused by a neurotropic virus, and that under natural conditions, tick-borne fever affected the course of louping-ill. Laboratory and field experiments culminated in the elaboration of a tissue vaccine which in general use over a number of years has led to spectacular decreases in mortality on affected farms. Much has been learnt concerning the nature of pregnancy toxaemia, and recent investigations give clear indications that the disease may be prevented by the provision of a proper diet during pregnancy. Out of a maze of confusing terms such as "moss ill," "moss staggers," "staggers," "trembling," it has become clear that lactating ewes suffer from a disease resembling milk fever in cattle, and there is evidence that the disease responds to calcium injections. According to some authors "pining" in sheep appears to be amenable to treatment by massive iron supplements. The rôle of other metals in the metabolism of the sheep has also become clearer. More recently, investigators in Australia and in Great Britain have been concerned with the relation between the copper intake of pregnant ewes and the incidence of swayback in their lambs, and their results have shown that swayback may be prevented by the provision of copper in the form of licks to the ewes during gestation.

Our record with swine diseases is less spectacular. Many diseases remain obscure, and when investigations on aetiology have been successful they have not been followed by successful control measures. It is a remarkable fact that since the opening years of the century little change has occurred in our methods of controlling swine erysipelas; this is probably a tribute to the success of serum therapy and the serum-culture method of immunisation. There is little doubt, however, that the technique of serum preparation has improved, and from records of early work it can be deduced that commercial sera are now greatly superior in their antibacterial activity to those prepared in earlier days. This absence of activity in the field of bacterial and virus disease affecting pigs is balanced by successes in the field of parasitology and constitutional disease. Ascarid infection is now adequately controlled on the majority of farms by treatment with carbon tetrachloride, while anaemia of young pigs is controlled with equal success by the use of iron compounds.

The horse has benefited mainly by advances in chemotherapy. There is now little room to doubt that the serious streptococcal infections of equines will respond to treatment with

sulphanilamide. We have lagged behind our allies in the application of tetanus immunisation to equines. For several years French army horses have been actively immunised by means of tetanus toxoid, and it has been shown that an immunity of long duration is conferred upon them.

Though our greatest poultry problem, fowl paralysis, remains unsolved, we have to our credit methods of controlling some important diseases of fowl, namely, fowl pox, B.W.D. and tuberculosis. Fowl pox vaccine prepared from pigeon pox virus has been shown to be effective in controlling fowl pox. It is claimed by some authors that certain arsenical preparations are of value in the control of blackhead in turkeys.

British manufacturers are in a position to supply adequate quantities of all preparations of proved value, and laboratory facilities are available for an unlimited demand in the field of biological testing.

To summarise, the scientific investigations of 1918 to 1939 have led to the elaboration of the following proved methods of controlling disease in farm animals:—

CATTLE.

Chronic Streptococcal Mastitis.—Bacteriological examination of milk, acriflavine infusion and sulphanilamide.

Contagious Abortion.—Routine blood testing and vaccination with avirulent cultures of adults or calves.

Tuberculosis.—Synthetic medium tuberculin.

Blackleg. — Formalin-killed vaccine (*Cl. chauvoei*).

Braxy.—Formalin-killed vaccine (*Cl. septique*).

SHEEP.

Lamb Dysentery.—Vaccine and serum (*Cl. welchii*, type B).

Pulpy Kidney Disease and Entero-toxaemia.—Vaccine and serum (*Cl. welchii*, types C and D).

Louping-ill.—Tissue vaccine.

Pregnancy Toxaemia.—Dietary control.

Lambing Sickness.—Calcium boro-gluconate.

"*Pining.*"—Iron salts.

Swayback.—Copper salts.

SWINE.

Ascarid Infestation.—Carbon tetrachloride.

Anaemia.—Iron salts.

EQUINES.

Streptococcal infections.—Sulphanilamide.

Tetanus.—Tetanus toxoid vaccine.

POULTRY.

Fowl Pox.—Pigeon pox vaccine.

Blackhead in Turkeys. — Certain organic arsenical preparations are worthy of trial.

The Veterinary Record

DECEMBER 30TH, 1939.

The Ministry of Food and Meat Inspection Services

IT is now common knowledge that at some date early in 1940, very considerable changes will be introduced in the system of marketing, slaughtering and distributing home-killed meat. The Ministry of Food proposes to become the sole purchaser of all fat stock, and have them slaughtered, processed out at and distributed from selected centres. This monopoly of the meat trade means a much greater measure of unified control over home-killed meat than has ever been contemplated. Many small private slaughterhouses will be closed and slaughtering will be concentrated in those which are selected as official centres. While this cannot be regarded as the planned *centralised* slaughtering which members of our profession, no less than many directly engaged in the various branches of the meat industry, have long wished might come about, it is perhaps a step in that direction. We must, however, remember that it is a war-time measure, having many of the faults of hastily conceived legislation and is a temporary expedient. Can we contribute to improve the design?

The N.V.M.A. has been endeavouring for some weeks past to learn from the Ministry of Food what proposals were contemplated with reference to *ante-* and *post-mortem* inspection of slaughter animals. It addressed a letter to the Ministry on November 3rd, but so far has had no reply. A special committee has been formed to review the situation and is preparing a memorandum in which the need for a properly constituted inspectorate will be surveyed. Such an inspectorate is as necessary in war-time as in peace and it will be even more essential if there is concentration of slaughtering. If we can judge from a reply given recently to a question in the House of Commons,* the Minister of Food acknowledges the responsibility attaching to ownership but does not appear to have realised the full repercussions

*Published in our issue of December 23rd.

of the scheme which is proposed, for in the reply it is implied that the inspection will be undertaken by the present inspectorate, which will continue to function under the new scheme.

Our readers will appreciate just what this reply entails. They will realise perhaps better than any, that in some few of the larger municipalities, where a *properly* constituted inspectorate is engaged and is functioning, the food inspection services will continue to be carried out in an able, efficient and economic manner. They will be able to appreciate just what the lack of a fully efficient inspectorate means, and how very many abattoirs and private slaughterhouses there are engaged in processing meat intended to be sold for human consumption, where but little pretence is made to have either the animals or the meat examined. In a few districts there is a regular trade in "screws" of all kinds, and meats of questionable character which are not normally dealt with at abattoirs where the system of inspection would most certainly prevent their being passed for human consumption. It is a trade which tends to be concentrated in the smaller and uninspected slaughterhouses, where unless the products are grossly diseased, they are offered for sale. It would be very interesting to know what the reactions of the public would be in some of these uninspected areas if they were fully acquainted with the facts.

If there is a case to be made for meat inspection, both *ante-* and *post-mortem*, surely one of the most important basic features of it should be uniformity of methods and standards throughout the country. Yet in Great Britain in 1939, there is not even a pretence of uniformity.

We are told that the resources of the country are to be mobilised to maximum capacity. Is it not then somewhat astonishing to learn that the Government proposes to remain satisfied with the existing system—or rather lack of system? One of the resources is a body of men, scientifically trained in all that pertains to animal health and disease and numbering among its members experts in the supervision of meat and meat products; the reputation of these men extends far beyond our own shores. Yet with some few exceptions our local authorities, owing to limited personnel, are permitted to leave this vital service to be performed in a perfunctory or inexpert manner, or more extraordinary still, are content to allow meat and meat products from diseased and even dangerously affected animals to find their way into retail circulation without passing any inspection whatsoever.

It may be that in certain circles there is a lack of knowledge of the capacity, scientific training, and abilities of members of the veterinary profession. Some fault may lie with ourselves for not having made it our business to impress upon Government more forcibly and frequently the comprehensive nature of our training and interests in all that pertains to the food animals and their products. We remember, however, a Royal Commission whose report has been ignored since 1921. Some day the country may have to bring a formidable indictment against the Ministry of Health, which is ultimately responsible, for the attitude of *laissez faire* and complacency.

In the meantime our readers may be assured that active steps are being taken to bring the facts to the notice of the authorities concerned, in the hope that the evil circumstance of war may be turned to good account in this respect.

SUFFOLK HORSE GRANTS

Sir Cuthbert Quilter, the president, speaking at a recent meeting of the council of the Suffolk Horse Society, said he was sure that as breeders of heavy horses they viewed with regret the stopping of grants to heavy horse societies by the Ministry of Agriculture. He had no doubt, however, the Suffolk heavy horse societies would continue to do good work and that the Suffolk Horse Society would give consideration to giving financial assistance to those who continued to operate. The Council is to try to make arrangements for assisting those heavy horse societies that had travelled Suffolks under the Ministry of Agriculture's scheme. General regret was expressed at the discontinuance of the grants in view of their excellent results.

* * * * *

BLACKING OUT THE BYRE

Limitation of light and restriction of ventilation caused by permanent blacking out of windows in byres is prejudicial to the health of animals and to the efficiency of the workers, says the Scottish Department of Agriculture.

For fixed roofs and windows in vertical walls, they recommend nailing a piece of close-woven sacking above or below the window and attaching a wooden rod along the whole length of the free end. A cord fastened to the centre of the rod and led through a staple fixed above the window will enable the sacking to be raised and lowered. Wooden shutters or frames covered with sacking may be used. Lamp shades made from biscuit tins or wooden boxes, are also recommended.

CLINICAL COMMUNICATION

Anthrax in Swine

J. E. SAUNDERS, M.R.C.V.S.
(BEDFORD)

Among the pigs upon which the writer has had occasion to make *post-mortem* examinations during the last two years were a number which were afterwards proved to have been suffering from anthrax, mainly of a localised type.

These cases were not reported as suspected anthrax, and were dealt with in a private capacity on behalf of the farmer client. The *post-mortem* examinations recounted below reveal the findings in five pigs, all from different farms and in various parts of the county.

It would appear from the literature that typical porcine anthrax is manifest mainly by swelling of the throat, accompanied by symptoms of dyspnoea, due to the entrance and multiplication of the bacilli in the tonsillar area, pharyngeal and retro-pharyngeal lymphatic glands, followed by a sero-haemorrhagic infiltration, and that anthracaemia in pigs is comparatively rare, the animal usually dying from asphyxia before the organisms reach the blood stream. In fifteen cases in pigs examined by Schlegel, however, eight were septicaemic and four localised intestinal anthrax; whilst of 68 cases examined by Frolich 65 were local and transitional forms.

Of eight cases seen by the writer one was septicaemic, two localised in the throat region, and five localised in the intestine. It is the *post-mortem* findings in the latter that are about to be described.

Post-mortem Findings

CASE 1. (*February 5th*, 1939.)

History.—Large Black sow, three years old, in good condition. She was due to pig in a month, and was in good health up to the time of death which was sudden; she was believed to have recovered from an attack of chronic erysipelas a year ago.

Time of *post-mortem* examination after death, approximately 14 hours.

Findings. — Slight epistaxis, subcutaneous haemorrhages and extending deeply into the fat under the skin, giving the fat a speckled appearance.

The throat was not notably swollen but the fat and muscular tissue in this region were deeply engorged; the sub-maxillary glands were purplish red and enlarged.

The epiglottis, larynx and pharynx were markedly congested through the depth of the mucous membrane which in places was covered by slimy blood-tinged mucus. The trachea and bronchi were affected in a similar way.

The lungs showed patchy congestion and petechial haemorrhages scattered indiscriminately throughout the organs. The myocardium was very dark with a few vibicial haemorrhages and engorged coronary vessels, the cardiac fat being reddened.

The stomach showed evidence of gastritis, the contents consisting of a mass of fermenting food. Both large and small bowels appeared normal, but the mesenteric lymphatic glands were enlarged and slightly reddened; there was some oedema of the mesentery. Both liver and spleen showed enlargement, though not marked, the former being very decomposed and friable. The cut surface of the spleen bulged from its capsule, was extremely soft and dark—almost black.

The kidneys were slighly enlarged, deeply injected with vibicial haemorrhages and contained cystic locul; the mucous membrane of the bladder was inflamed. The uterus, which was apparently quite healthy, contained 15 well-formed foetuses.

It was interesting to observe that in this case of anthracaemia the spleen was not more enlarged than one would expect to find it in a case of erysipelas.

The natural colour of the pig masked any evidence of skin discoloration. Organisms were easily demonstrated in all organs and the blood.

CASE 2. (*March 2nd*, 1937.)

History.—Found dead in the morning. The owner sustained a similar loss six weeks ago, the pig being found dead in the morning having shown no previous signs of ill-health; anthrax had not previously occurred on this farm.

Time of *post-mortem* examination after death was 12 hours.

Findings.—No discoloration of the skin, swelling of the throat nor epistaxis. The epiglottis, tonsillar area and trachea presented similar changes to those in Case 1.

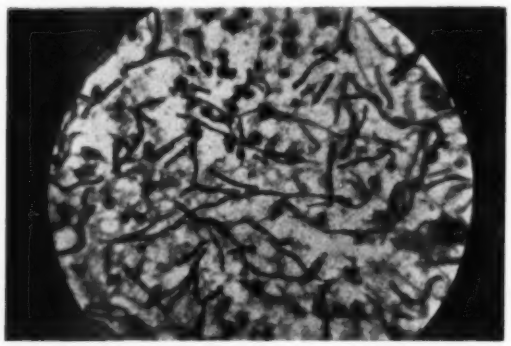
Small petechiae on lung surface and hypostatic congestion. Heart apparently normal. Spleen very slightly enlarged, normal in colour and consistence. Kidneys normal, mucous membrane of bladder slightly inflamed. Stomach: small patch of inflammation at oesophageal end. The liver also apparently normal. The mesentery was greatly thickened and oedematous, in one part consisting of a friable mass which gave the sensation of cutting a piece of liver when severed with a knife, the exposed surface being minutely honeycombed and exuding a sanguineous transudate together with chyle from involved mesenteric lymphatics. Between the coils of the large intestine a large amount of gelatinous

transudate was observed. The lymph glands in the mesentery were enlarged and showed haemorrhagic areas.

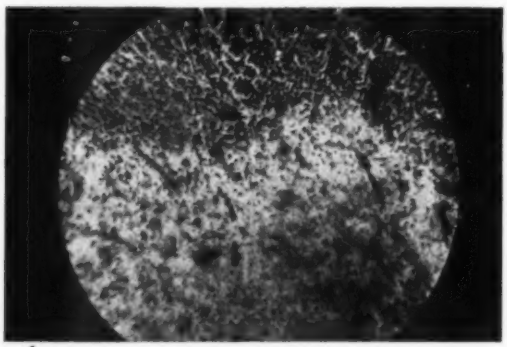
The serous surface of parts of the large colon showed inflammation and small pieces of adherent fibrin. The deep inguinal and submaxillary lymphatic glands were enlarged and haemorrhagic.

The abdominal cavity contained a large quantity of ascitic fluid. Smears taken and examined from the submaxillary glands, tonsillar area, spleen and heart proved negative to the presence of bacilli.

The mesenteric lymphatic glands, and oedematous parts of the mesentery, showed vast numbers of exceptionally large organisms.



1. Smear from mesenteric lymphatic gland. Note great length and size of the bacilli.



2. Paraffin Section of a mesenteric lymphatic gland, showing normal and necrosed areas.

Case 3. (*September 3rd*, 1937.)

Eighteen months old Large White sow: condition good.

History.—Ill for three days; not professionally attended. The owner noticed a swelling in inguinal region involving the posterior mammary glands. No epistaxis or throat swelling.

Anthrax was confirmed on this farm six months previously.

Time of *post-mortem* examination after death, about six hours.

Findings.—Larynx, tonsillar area and trachea very inflamed, especially the last-mentioned which was covered by slimy blood-stained mucus due to rupture of submucous capillaries.

Grey hepatisation of posterior lobe of left lung and slight adherent pleurisy of right posterior lobe.

Petechiae in myocardium; no blood clots in any of the cavities, the blood being very dark; there appeared to be an excess of pericardial fluid; fatty degeneration of the liver and kidneys. The spleen appeared quite normal. Gastritis very marked. Faeces solid in the large bowel, the mucous membrane of which was very injected. Mesenteric lymphatics enlarged and slightly reddened. The mucous membrane of the bladder showed a patchy inflammation. The swelling in the left inguinal region was due to a gelatinous transudation, the regional lymph gland being enlarged and intensely reddened. A bacterioscopic examination was made of the systemic blood, spleen, liver and submaxillary lymphatic gland and proved negative to the presence of *B. anthracis*. The organisms were demonstrable in the superficial inguinal lymphatic gland in large numbers; a few bacilli were found in the mesenteric lymphatics, whilst in the inguinal fat and oedema surrounding the local lesion, the organisms were present but only in very small numbers.

Case 4. (*January 4th*, 1939.)

Two-year-old cross-bred sow: condition good.

History.—No previous outbreaks of anthrax on the farm. A *post-mortem* examination was made on one sow only. Animals were found dead in the morning, having shown no symptoms. On an adjacent farm belonging to the same owner, a bullock had died from anthrax. The farmer subsequently lost two sows. A *post-mortem* examination was made on one sow only, the other sow being in a state of putrefaction. Anthrax was suspected and the usual procedure adopted. Smears from the throat and blood from the ear were negative.

Time of making *post-mortem* examination after death, about six hours.

Findings.—Slight expistaxis; no swelling of the throat; the sub-maxillary lymphatic gland was enlarged and reddened. Pharynx, larynx and tr chea all inflamed. Chest cavity and contents apparently normal. On exposure of the abdominal cavity large quantities of sero-fibrinous fluid were expelled. Almost the full length of the large intestine was salmon pink in colour, the serous surface being coated with fibrin, more particularly in one part

Table

Case.	Site of Local Lesion.	Nose and Anus.	Respiratory Tract.	Abdomen.	Stomach.	Bladder.	Spleen.	Time of *Post-mortem* Examination after Death.
1	None found (septicaemia)	Blood from nose and anus	Petechiae in lungs and trachea. Tonsils and glottis congested	No ascites	Inflamed	Inflamed	Slight enlargement	14 hours
2	Mesenteric lymphatic gland	No blood	.. ..	Ascites, peritonitis	Slightly inflamed	Slightly inflamed	No enlargement	12 hours
3	Superficial inguinal lymphatic gland	..	Pneumonia and pleurisy	No ascites	Inflamed	..	Slight enlargement	6 hours
4	Mesenteric lymphatic gland	Slight blood from nose	Trachea, tonsils and glottis congested	Acites, peritonitis	..	Normal	?	6 hours
5	.. ..	Blood from nose	Glossitis, pleurisy, no pneumonia	.. ..	..	..	Normal	6 hours

involving adherent loops of bowel and mesenteric lymphatic glands. On dissecting this region the mucous membrane was found to be deeply necrosed almost to the extent of complete penetration. The necrosed mucous membrane and that in the vicinity of the lesion was of an orange rust colour; the inter-intestinal connective tissue, mesentery, and lymphatic glands were markedly oedematous. Smears from this region proved positive to *B. anthracis*, which were few in number and small in size. Putrefaction in other organs, particularly in the liver and kidney, had established itself and masked any *ante-mortem* changes.

Case 5. (*October 10th*, 1939.)

Five-month-old Large White sow, in good condition.

History.—Brought on to the premises four months ago: no other pigs introduced since. No cake fed to pigs. Subject not obviously ill the night previously: found dead in morning. Anthrax not known to have existed on farm before.

Findings.—Rectal mucous membrane everted, epistaxis slight and blood-stained discharge from ocular canthi. About 2 quarts of frothy blood-stained fluid in abdominal cavity. Visceral and parietal peritoneum injected; mesenteric lymphatic glands haemorrhagic and showing frothy oedema. Small bowel eroded locally; rust-coloured mucosa; gelatinous oedema of mesentery. Fibrinous adhesive peritonitis. Bladder normal. Fibrinous pleurisy, but no pneumonia. Phlegmonous gastritis. The superficial inguinal glands were enlarged and haemorrhages were found in the sub-maxillary gland. Blood-stained froth in the trachea, and glossitis.

Anthrax bacilli were found in the mesenteric lymph gland affected, but were absent from the spleen heart blood and submaxillary lymphatic glands.

. . . . .

It will be noted from the above tabulated statement that the most constant lesions exhibited in the last four cases, *i.e.*, those pigs affected only locally, are inflammatory changes in the respiratory tract and stomach, and that where the local lesion is a mesenteric lymphatic gland, ascitic fluid is a prominent finding. It is not suggested that the above are pathognomonic of anthrax in swine, but where such a combination of pathological changes presents itself at an autopsy a very thorough search for localised anthrax should be made; furthermore, when a suspected lesion has been disclosed it is important that a number of bacterioscopical examinations be made from the tissue, as often the organisms are so few in number that they may be missed; this applies in particular to the oedematous material surrounding a lymph gland.

It is suggested that the inflammatory changes produced in the abdominal cavity, more particularly the peritonitis, are produced by secondary invaders, which may easily gain access through the eroded mucous surface of the bowel lumen. This erosion is characteristic, and occupies various lengths of the bowel (generally the large bowel)—usually, however, about 4 to 10 inches—

and is quite sharply defined from the normal mucous membrane; the necrotic surface is markedly thickened and is brittle.

It will also be observed that pneumonia and/or pleurisy may be the complicating lethal factor. Although the evidence is not abundant here, the writer, from the above observations, feels inclined to assume that localised anthrax is a chronic disease and death is not directly produced by anthrax bacilli (or their toxins?) unless they gain access to the blood stream; in short, pigs have considerable resistance to this organism.

When preparing slides for microscopical examination fat is sometimes unavoidably included in the preparation, and staining is rendered difficult; in fact, sometimes the smear does not stain at all. This difficulty is overcome by quickly running some xylol over the smear, followed by alcohol; it is then washed in water and restained with methylene blue.

Overheating when fixing does not appear to alter the appearance of the organisms and usually the capsule remains intact.

McFadyean's reaction is dependent on the number of organisms present and should not be relied upon when examining material from local lesions where only a few bacilli may be present.

It is well known that bacterioscopical examinations that are made with material from animals that have been dead some length of time, especially in warm weather, reveal vast numbers and varieties of organisms, and frequently in these circumstances some little doubt may exist in the mind of the examiner as to whether or not he is dealing with a case of anthrax. In positive cases, however, the capsular material, though very much disintegrated is present, and stains pink with methylene blue; this greatly assists diagnosis.

Treatment and Prophylaxis

The writer's experience in the treatment and prophylaxis of this disease is practically negligible, but the results obtained following the use of Pasteur's double vaccine as a preventative measure in a fairly large number of pigs and cattle, on two separate farms, have so far been most encouraging.

The respective owners of these two farms were repeatedly losing either pigs or bullocks from anthrax, and it may be significant that in all but one instance, where a pig had died of the disease, some form of pig nuts had been fed to them.

Temperatures were taken of in-contact pigs, but the readings were normal in all cases; nevertheless, each in-contact pig received a 10 c.c. dose of anti-anthrax serum. The remainder of the breeding stock—some 50 or 60 on each farm—was inoculated with Pasteur's vaccine: each receiving $\frac{1}{4}$th c.c. intradermally either in the tail or loins, followed in twelve days by a further $\frac{1}{2}$th c.c. of the second vaccine.

The reaction in some of the pigs was more pronounced than in others. The site of inoculation became painful and swollen, the appetite being in abeyance with pyrexia. These symptoms in a few instances lasted two or three days; a few suckling pigs, presumably through lack of milk from the parent, succumbed.

The immunity produced by this method is said to last about one year when a further dose should be administered. It is now two years since the pigs referred to above were inoculated (once only by the double method) and losses from anthrax on these farms have not occurred since.

The second year of freedom from the disease may have just been good fortune, but one may justly assume that a satisfactory resistance had been established in the pigs the preceding year.

Summary

1. A somewhat detailed description of the *post-mortem* findings in five cases of anthrax in pigs has been given. It is hoped that they may be of some assistance in diagnosis since it is the writer's belief that localised anthrax in swine is far more prevalent than is generally supposed.

2. Pigs appear to have considerable resistance to *B. anthracis*, and death in cases where the organisms are only localised is not produced by anthrax but by some secondary agent.

3. It is evident that a local bowel lesion may be a dangerous manifestation of anthrax in pigs as the organisms could be discharged in faeces and contaminate premises.

4. It is often necessary completely to disembowel a pig in order to determine the cause of death, and should intestinal anthrax be found an explanation to the Ministry of Agriculture and Fisheries is demanded. It is unfortunate that a pig should have to be so mutilated before arriving at a diagnosis; the only possible alternative is perhaps the submission to a laboratory of ascitic fluid drawn from the abdomen.

It can be perceived, however, that the cutting of the carcase of a pig dead of localised anthrax would not entail anything like the danger of severing the smallest vein in a case that was generalised.

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ABSTRACTS

[Immunisation of Laboratory Animals and Sheep against Anthrax by means of Non-capsulated but Oedema-producing Strains of B. anthracis. (Trans. title.) Stamatin, N. (1938.) *Ann. Inst. Past.* **61.** 394.]

When virulent strains of *B. anthracis* were cultivated on citrated or defibrinated horse blood, in addition to the smooth round colonies of capsulated organisms the author obtained occasional rough variants which consisted of non-capsulated organisms. These non-capsulated strains gave rise to oedema on subcutaneous injection into mice, guinea-pigs and rabbits. In mice, the injections often proved fatal, but guinea-pigs and rabbits usually recovered. In the animals which died there were few organisms present and these had little or no capsule.

A series of studies was made on the immunising power of these oedema-producing strains. They appeared to confer a certain degree of immunity to mice and gave a solid immunity to guinea-pigs and rabbits, the immunity being proportional to the degree of oedema produced. It was found that sheep also could be immunised against anthrax by subcutaneous injection of a 24-hour broth culture of these non-capsulated strains. The sheep showed a thermal reaction and a diffuse oedema at the point of inoculation which soon disappeared. Sheep so immunised resisted large doses of a virulent culture of *B. anthracis*.

A. R.

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[Experiments on the Transmission of Bovine Contagious Pleuro-pneumonia, with a Report on a New Method of Testing Immunity following Vaccination. Mettam, R. W. M., and Ford, J. (1939.) *J. comp. Path.* **52.** 15-28.]

Emboli were prepared by mixing 5 per cent. virus or culture with 10 per cent. agar cooled to 40° C., and aspirated into cannulae 90 mm. long with a bore of 9 mm. On setting, these emboli, which might measure 80 mm. by 8 mm., were driven into the jugular vein by the trocar, a slightly larger cannula being first inserted into the vein to guard against contamination of perivascular and subcutaneous tissue.

Out of 17 cattle drawn from areas free from pleuro-pneumonia, inoculated in this way, six animals resisted infection, but eleven developed clinical symptoms after an incubation period of about a week. Lung lesions alone were found on *post-mortem* examination in five cases, whilst in six cases both lungs and pleural lesions developed, and in seven cases sequestration developed, encapsulation sometimes being complete as early as 15 days after the appearance of clinical symptoms.

It is pointed out that testing the immunity produced by culture vaccine has been unsatisfactory as exposure to natural infection is not reliable as a method of transmission, and subcutaneous inoculation may produce no severer local reaction in a susceptible animal than it does in an immunised one.

Out of ten animals immunised with culture vaccine, and tested by the intravenous injection of agar emboli, only one showed evidence of reaction, whilst out of ten controls five developed extensive lesions of contagious bovine pleuro-pneumonia.

U. F. R.

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[Experiments in Calves on Immunity Conferred by Single and Double Injections of BCG in an Oily Excipient. Buxton, J. B., and Glover, R. E. (1939.) *J. comp. Path.* **52.** 47.]

The authors recount a further experiment designed to ascertain the degree of immunity afforded to tuberculosis by the previous injection of B C G in an oily excipient.

In a previous experiment where four calves had been vaccinated in this manner, a satisfactory degree of immunity was demonstrated. A large number of animals was used in the experiment now recorded and the immunity produced by the subcutaneous injection of vaccine suspended in olive oil tested by the oral administration of virulent culture six months later.

It was found that no appreciable immunity was evident in three calves which had received 5 mg. of vaccine, although a moderate degree of protection was afforded to three calves out of four receiving 50 mg.

By repeating the vaccination twelve months after the initial dosage it appeared that three out of six calves had developed a higher degree of resistance than those in the previous groups.

S. J. E.

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[Immunity Experiments on Guinea-pigs with Killed Tubercle Bacilli and BCG. Griffith, A. S., and Glover, R. E. (1939.) *J. comp. Path.* **52.** 57.]

An interesting series of experiments was carried out to determine the resistance conferred on guinea-pigs to infection with virulent tubercle bacilli after previous infection with one of five different vaccines—four of virulent bacilli killed by heat (60° C. and 120° C.) formalin and glycerine respectively and one of B C G.

Assessment of the degree of resistance in the vaccinated groups of guinea-pigs was made by comparing their relative survival time and the

extent of the lesions with those of a control group after infection with virulent organisms either intradermally or by the conjunctival route.

While marked individual differences were noted in the animals of each group, the results generally indicate that vaccination did not confer a high degree of immunity and was effective in diminishing the extent and severity of the generalised tuberculosis in only 50 per cent. of the animals. The best results were observed in the group vaccinated with B C G, and this was succeeded by results in the group which had received organisms killed at 120° C.

S. J. E.

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[**Sulphanilamide and Diaminodiphenylsulphone and their Diacetyl Derivatives in the Treatment of Experimental Intradermal Streptococcus Infections of Rabbits.** Kolmer, J. A., Raiziss, G. W., and Rule, A. M. *Proc. Soc. Exp. Biol. Med. N.Y.* **39.** 95-98. (1 tab. 5 refs.).]

The intradermal injection of virulent beta haemolytic streptococci into the abdomen of rabbits produces a severe local lesion which is admirably suited for chemotherapeutic investigations. Lesions thus induced were used throughout this investigation.

Five infected rabbits were given 0·05 to 0·5 gramme sulphanilamide per kilo. per day for five days, the first dose being given 24 hours after infection. Improvement began on the second to fifth days of treatment and was well marked on the seventh day, but cultures were still positive on the tenth day.

Another five received 0·1 to 1·0 gramme of the acetyl derivative of sulphanilamide orally per day for five days. There was no clinical improvement, and the rabbits receiving 0·8 and 1·0 gramme succumbed to the toxicity of the drug. All lesions were positive on the tenth day.

A further batch of five rabbits were given 0·05 to 0·5 gramme 4 : 4′-diaminodiphenylsulphone per kilo. per day for five days. Improvement began in two to three days and the two rabbits receiving 0·4 to 0·5 gramme were completely healed on the fifth day of treatment and showed negative culture.

The five rabbits remaining received the diacetyl derivative of 4 : 4′ diaminodiphenylsulphone orally in doses of 0·1 to 1·0 gramme per kilo. daily. Doses of 0·8 and 1·0 gramme produced some healing on the fourth and fifth days, and sterile cultures on the tenth day, but smaller doses had no effect.

The chief conclusions are that 4 : 4′-diaminodiphenylsulphone was more effective than sulphanilamide, and produces complete sterilisation if given in sufficient dosage. Sulphanilamide is clinically effective but does not give a sterilising cure with the dosage employed.

D. D. O.

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[**Infectious Gastroenteritis of Cats.** Salsbery, C. E. (1939.) *J. Amer. Vet. Med. Ass.* **95.** 195-200. (10 refs.).]

The aetiology, characters and general treatment of infectious gastroenteritis of cats are discussed.

Recent studies have left no doubt that the exciting cause of the condition is a filterable virus which can be recovered from the brain, spleen, kidneys, urine, faeces and blood.

Vaccination with a single dose of formalin tissue vaccine prepared according to the method of Urbain (*Ann. Inst. Past.*, 1933. **2.** 203-214) affords solid immunity against fatal exposure to the virus, while homologous antiserum from hyperimmunised adult cats gives satisfactory protection. Simultaneous vaccination with serum and virus sets up immunity of longer duration.

Attempts to produce a satisfactory heterologous antiserum by hyperimmunising mules have so far been unsuccessful. Such an antiserum will protect 66 per cent. of vaccinated cats, but 50 per cent. develop abscesses at the site of injection. Serum preparation on a commercial basis is, therefore, not yet possible.

D. D. O.

REPORT

[**Army Veterinary Service in India.** Administration Report, 1938-39.]

This report no longer deals with the Army in Burma, so comparative figures for previous years have no value.

The average animal strength included 28,469 horses, 27,416 mules, 3,804 camels, 12,996 cattle and 177 donkeys or a total of 72,862.

The establishment of the Army Veterinary Service during the period under review included British cadre officers 35, British officers, continuous Indian cadre 28, Indian commissioned officers 16, veterinary assistant surgeons 125 and, in addition, a number of other ranks, clerks and followers. Military veterinary institutions comprised 67 hospitals, two schools, a record office, a depot and a laboratory.

It is stated that the laboratory continues to perform excellent work and that it is well equipped. A good library is being built up. A consider ble amount of experimental work was undertaken but no important conclusions were arrived at.

Disease

The general condition of the animals in the Army is stated to have been good.

Under "general diseases," there was some increase in the number of admissions for *colic* in the Western District where the animals are fed largely with *bhoosa* (straw chaff). Silage has been issued in limited quantities as a corrective with successful results.

Paraplegia and *paralysis* continue to give trouble. Injuries from *kicks* are regarded as being far too high, due largely to faulty stable management.

Under "specific diseases" there was a decrease in the incidence of *anthrax* and only one case of *glanders* occurred. The beneficial results obtained from the administration of neosalvarsan in contagious pneumonia in horses is again remarked upon.

Encephalomyelitis in equines caused considerable concern and up to the present no effective treatment has been discovered. This disease is sometimes confounded with paraplegia. The importance of *influenza* is emphasised in the report. This disease is apt to have serious consequences on occasion. The value of goat virus vaccination against *rinderpest* among the cattle of the Military Farms Department is very favourably reported upon.

There was a marked reduction in the prevalence of *strangles* which is particularly rife in the remount depots. Treatment for this disease is being actively investigated but no notable success has resulted.

Surra causes considerable anxiety but is controlled on the whole with success. In the horse-breeding areas *joint-ill* was more prevalent than in the previous year but it is noted that in many cases the diagnosis was doubtful.

The special investigation in sterility in mares aided by a grant from the National Horse Breeding and Show Society of India, is being continued. The mucous test for pregnancy is being applied. The diagnosis and treatment of pathological uterine conditions received close attention. Artificial insemination was carried out in a number of mares.

The diagnosis and investigation of contagious disease is obviously a matter of deep concern in the Service and receives very laudable attention.

The Director gratefully acknowledges the assistance received from the staff of the Imperial Veterinary Research Institute, Mukteśar, and the Punjab Veterinary College.

G. K. W.

The Jersey cow Pearceland's Eileen 10th, owned by Mr. J. W. McCallum, Chartridge, Chesham, has created a record by producing 21,707½ lb. of milk, and 1,103·50 lb. of butter fat in 361 days.

N.V.M.A. DIVISIONAL REPORT

South-Eastern Veterinary Association*

SUMMER MEETING AT WYE COLLEGE

The summer meeting of the Division was held on June 29th, 1939, at Wye Agricultural College, at the kind invitation of Dr. A. D. McEwen.

The following fellows and visitors signed the attendance book: *Members.*—Messrs. E. P. Barrett (President), J. G. Cattell, A. T. Crowther, J. B. Dier, R. C. U. Fisher, J. G. E. Gallie, F. C. Gillard, S. F. J. Hodgman, J. F. Macdonald, A. D. McEwen, F. Marks, R. F. Montgomerie, G. E. Oxspring, C. W. Perrin, J. S. Steward, A. Thomson (Secretary) and Mrs. A. Thomson. *Visitors.*—Messrs. H. A. Crawshaw (Bechuanaland), E. Gray, J. Stewart and J. T. Turney.

A most interesting talk was given by Dr. McEwen on the work being done at the Wye College on contagious abortion. Keen interest was displayed in the talk and many points were raised by members. These were ably answered by Dr. McEwen. Members were then entertained to tea, during which a vote of thanks to Dr. McEwen and his staff, for providing such an instructive and entertaining afternoon, was proposed by Captain Gillard and heartily endorsed by all.

Before the short business meeting which followed tea, the President paid tribute to the late Sir Frederick Hobday (hon. member of the Division) and also to Mr. H. P. Hogben (a past President of the Division). Members stood in silence in tribute to their memory.

The following correspondence was then dealt with: (1) A letter from Major Dunkin intimating his wish to tender his resignation on account of his inability to attend any of the meetings. On the proposition of the Hon. Secretary, Major Dunkin's resignation was accepted, but in appreciation of his long connection with, and services to, the Division it was further proposed that he be elected an honorary life member. The proposition was unanimously carried and the Hon. Secretary was instructed to advise Major Dunkin of his election.

(2) Correspondence from the General Secretary of the N.V.M.A. in connection with A.R.P. (Animals) Service and refresher courses in poultry husbandry. After discussion, the Hon. Secretary was instructed to forward the considered replies of the Division to Mr. Knight.

The meeting then terminated.

Alex. Thomson, *Hon. Secretary.*

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*Received for publication, December 22nd, 1939.

ROYAL COLLEGE OF VETERINARY SURGEONS

Membership Examinations, December, 1939

LIST OF SUCCESSFUL CANDIDATES

(*Continued from page* 1455)

Glasgow

FIRST YEAR:

Brown, W.	Rees, L. F.
Dalling, D. D.	Scott, J. R.
Ferguson, M.	*Snowden, J. S.
McEwan, T.	Tufts, F. A.

*Denotes second-class honours.

THIRD YEAR:

Aupret, D. (A)	Lewis, A. C. (A)
Bannister, J. D.	Mackay, J. R.
Bhal, P. N. (A)	Mackenzie, G. A. (P)(A)
Bhardwaj, V. R.	McLauchlan, D. (P)
Black, W. W.	Maclean, J. B.
Brown, J. (Glasgow)	Meikle, H. A. G.
Brown, R. A.	Muir, Robt. (A)
Brownlee, W. A. D.	Peoples, John
Cassells, J.	Pomphrey, A. M.
Edwards, J. R.	Samuel, Miss M.
Evans, R. P.	Semple, W.
Fraser, John	Stewart, Thos.
Frith, H.	Wilson, J. C.
Gorman, E.	Wilson, Robt.
Harris, G. W.	Wilson, W. R.
Howatson, John	Young, James
Johnston, A. (A)	

(P) Denotes credit in Pharmacology.
(A) Denotes credit in Anatomy.

(*To be concluded*)

ARSENICAL DIPS

"Since the beginning of September, the Government have been buying up all available stocks of arsenic—not, presumably, for making sheep dips—and commercial buyers are having extreme difficulty in getting supplies," states the *Farmers' Weekly*, which proceeds: "Most of our arsenic, before the war, used to come from Germany and Sweden, and now it seems that the latter country is almost as effectively cut off as the first. So far-sighted sheep farmers are now wondering (*a*) whether there will be any arsenical dips, and, if there are, (*b*) what will they be asked to pay for them?"

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Jan. 1st, 1940.—Meeting of the Editorial Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 4 p.m.

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FOOT-AND-MOUTH DISEASE OUTBREAKS

The existence of foot-and-mouth disease was confirmed on Saturday last among carcases at the city abattoir, Birmingham. The area subject to restrictions in the movement of animals lies in the counties of Stafford, Warwick, and Worcester.

In connection with the above-mentioned outbreak, it will probably interest our readers to learn that the N.V.M.A. in its memorandum to the Ministry of Food, to which reference is made in our leading article and which is nearing completion, anticipated that it was not unlikely that outbreaks of foot-and-mouth disease might readily occur in selected centres where large numbers of animals are concentrated for slaughter. We may have occasion to refer to this outbreak again in a future issue.

Two more cases of foot-and-mouth disease in Suffolk, at Bramfield, near Southwold, and at Sotterley, near Beccles—making five cases in all that broke out over the Christmas holidays—were confirmed on Wednesday last. Further suspected cases are being investigated.

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Personal

MR. P. J. KERR, M.R.C.V.S., I.V.S.

SERVICES TO THE GOVERNMENT OF BENGAL

Mr. P. J. Kerr, who for many years held the post of Veterinary Adviser to the Government of Bengal, finally retired from Government service on October 10th, 1939.

Mr. Kerr graduated at the Royal Veterinary College, Camden Town, in 1906 and joined the old Indian Civil Veterinary Department in 1911.

After receiving training at the Bengal Veterinary College and in district work in the Central Provinces, he officiated as Superintendent, Civil Veterinary Department, Madras, for six months in 1912 and then returned to Bengal and took charge as Superintendent, Civil Veterinary Department, of the newly constituted province in October, 1912. With the exception of a break for military service from 1915 to 1919, he continued to serve in that province until April, 1938.

During the last war, he served for 18 months with the 6th Division in Mesopotamia under General Townsend and then being invalided to India he was transferred to the 3rd Lahore Division and from there to the South Waziristan Field Force and Muree Expeditionary Force. He

retired from military service in 1919 with the rank of Major.

Although his efforts in Bengal unfortunately coincided with the terrorist movement in that province, which naturally handicapped him in obtaining funds for the expansion of his department, eventually in 1938 he had the satisfaction of seeing his scheme of reorganisation, under which the Provincial Government took over charge of the district touring staff of the province and made themselves responsible for dealing with all contagious diseases of animals, brought into force.

A major effort in his service was the use of "goat tissue vaccine alone" as the routine method for controlling rinderpest in the field in the place of the older and more expensive "serum alone" method. Bengal was a pioneer in the use of this method on a large scale in the face of outbreaks of the disease and was the first province to set up a special rinderpest vaccine-producing station of its own. The energy and careful supervision which he gave to this work has not only benefited very greatly the province of Bengal, but it has already exerted considerable influence on the whole question of rinderpest in India, for it seems that the usual lines of invasion by this disease are from Burma and further east through the eastern districts of Bengal, and with this very efficient method of dealing with the disease the establishment of a rinderpest-immune belt for India does not seem so difficult of achievement as at one time appeared to be the case.

In November, 1938, Mr. Kerr was recalled from leave in England to officiate as Animal Husbandry Commissioner with the Government of India.

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Marriage.—Bowden, R. S. T.—Winkfield, I. A.—At St. Paul's Church, Parkstone, on December 5th, the marriage took place between Rufus S. T. Bowden (late Captain R.A.V.C.) of the Colonial Veterinary Service, younger son of Mr. and Mrs. T. A. Bowden, Breinton, West Hill Avenue, Epsom, and Isabel Mary Winkfield, youngest daughter of Lieut.-Colonel W. B. Winkfield and the late Mrs. Winkfield, of Guernsey. In the unavoidable absence of his great friend Harry Edwards, M.R.C.V.S., of Kingston, the duties of best man were carried out by the bridegroom's brother, Mr. Lester Bowden.

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R.C.V.S. OBITUARY

Malone, Patrick Joseph, Capt. R.A.V.C. (R.O.), Regal House, Exning, near Newmarket. Graduated Dublin, December 11th, 1908. Died December, 1939; aged 53 years.

Captain P. J. Malone was a son of the late Mr. and Mrs. E. Malone, Lucan, Co. Dublin. After qualifying, he joined the Royal Army Veterinary Corps and went to India. He also served during the Great War. Later he practised at Lucan and was well known in Irish bloodstock circles. He was a member of the Ward Union and other hunts. In recent years he was attached to the Macomber stud farm at Quesnay, France, and the Lord Glanely stud farm at Newmarket. He is survived by his widow.

ARMY VETERINARY SERVICE

London Gazette—War Office—Regular Army (Emergency Commissions)

December 22nd.—To be lieutenants: (November 27th)—D. W. Jolly; (November 29th)—R. C. Crowhurst; (December 3rd)—F. L. Cundell (late captain, R.A.V.C.).

Territorial Army

Captain F. L. Haydon relinquishes his commission on account of ill-health and retains his rank, with permission to wear the prescribed uniform (December 23rd).

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MANAGEMENT OF DOMESTIC ANIMALS: A "WAR UTILITY EXHIBITION"

"The authorities at the Zoo have been considering ever since the outbreak of war how the Society might play its part in national service," states *The Times*, which continues: "The various A.R.P. organisations were set up with exemplary swiftness, but such matters are the duty of any similar body. For some time the Society has been discussing with the Ministry of Agriculture and the London County Council plans for an exhibition of the management of domestic animals, to be known provisionally as a War Utility Exhibition. Something of the sort was displayed in the Gardens during the last war, but the Zoo is determined to put on a very much more comprehensive show. To this end a panel of experts has already been formed, and the Zoo is in touch with poultry clubs, rabbit clubs, bee-keeping organisations, goat societies, and the like. The exhibition may open in early May and will certainly include chickens, pigs, rabbits, goats, pigeons, silk-worms, and bees."

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SCIENTIFIC RESEARCH AND AGRICULTURE*

We reproduce below, by the kind permission of the speaker and of the Editor of *Nature*, extracts from an address delivered by Sir Thomas Middleton, K.C.I.E., K.B.E., C.B., F.R.S., a man who has had more to do with veterinary research than any other official. Sir Thomas has sat on the Development Commission since its inception, first as Vice-Chairman and later as Chairman. He is now Chairman of the Agricultural Research Council. We are making the present address available to our readers because it includes, as an important part of the subject under review, the progress of research in veterinary science.

When, in 1912, Section M held its first meeting, my presidential address was upon the early improvers of husbandry, and I referred especially to the assistance given to agriculture through the societies and associations formed by them for promoting experiments and discussion. Section M was the latest addition to associations of the kind, and we who were then

*From Part II of the presidential address entitled "Practice with Science," Section M (Agriculture) of the British Association, delivered at Dundee on August 31st.

present looked forward with expectation to the benefit agricultural science would get from the formation of the new section. In spite of the calamity of the War of 1914-18 and the unrest in the world which has since developed, I feel sure that, in returning to Dundee where that first meeting was held 27 years ago, all will agree that the hopes then formed have been more than fulfilled by the progress of Section M.

My purpose in selecting the motto "Practice with Science" is not to use it as an occasion for a review, but so that I may refer to matters affecting the present circumstances of both partners in the motto. The existence of Section M is in itself a proof of the large amount of scientific work now being carried out on behalf of agriculture, and also of the interest which the scientific public take in the subject. Although it has many shortcomings, as the workers concerned will be the first to admit, it may be claimed for agricultural science that it has prospered and is prospering; in contrast, everywhere there is evidence of the difficulties of agricultural practice.

With subsidies, price insurance and other measures of the kind for assisting agriculture which at present occupy so much of the farmer's thoughts, the majority of scientific workers have no direct concern. The remedies for agriculture's handicaps which they have to offer depend on research, and fortunately research is a remedy so widely approved that, when it does arouse criticism, the complaint usually is that too little use is made of it and that the financial resources provided are too meagre.

For criticism of the kind there is, no doubt, justification; but in the past 30 years, scientific research in agriculture has made great progress in Great Britain, and the prospects for further progress are now better than they ever have been. The subjects under investigation at our research institutes and university departments of agriculture are so numerous that the time at my disposal would not permit me to comment on them in any adequate way. My remarks on the scientific workers' programmes must necessarily be of a very restricted kind.

As for meagre financial resources, no one can be more conscious of the needs and demands of the scientific worker than I am. During long years in Whitehall, I have many times reflected that the doctrines of Malthus, confounded though they may be by twentieth-century birth statistics, are peculiarly applicable to agricultural science; the pressure of its annual recruits on the means of subsistence has given me many an anxious hour. Yet when I look back to the first years of the century, when Hall, Russell, Percival and Theobald were breaking new ground at Wye, when Wood and Biffen were making the reputation of the Cambridge School of Agriculture, when Somerville had already shown how pasture improvement may be effected and measured, it is not the meagreness, but the growth of the resources now available to the agricultural worker that impress me. For I recall that, in the first report to be written by me in Whitehall Place, I had to point out that for the purpose of experimental work and research the State had granted no more than £380, whereas in the present year the Development Fund, which Mr. Lloyd George provided for us in 1909, is assisting the scientific worker in agriculture, and through him the British public, to the extent of some £500,000; and the Development Fund, although much the most important, is not the only source of funds available.

It is questionable if the general public realises how largely the programmes of the agricultural investigator are framed in the interests of the nation as a whole. Indeed, if these programmes were framed solely for the farmer's benefit, some who have read my doleful account of the difficulties caused to the unhappy farmer by surfeited markets, may suppose that my remedy would be transference of the millstone of surplus from the shoulders of the producer to the neck of the scientific worker! But although fully conscious of the large increase in world production recently brought about as a result of the activities of plant breeders, chemists, pathologists and others, I trust you will not think my logic faulty if I disclaim any such idea.

Take, for example, the benefits that both agriculture and nutrition would derive from discoveries that would improve the health of farm livestock. By raising the standard of health in domestic animals we would meet some of the most insistent demands of nutrition experts. It is generally agreed that nothing would do more to reduce the number of C3's among us than an increase in the consumption of milk and eggs; it is generally claimed, too, that to secure increased consumption, prices must be less than they now are, and I believe it will be held by those who have studied costs of production that the possibility of lowering prices depends first and foremost on improving the health of the cow and the hen. So long as the wastage in dairy herds and poultry flocks remains at the present level, it is difficult to see how the cost of milk and eggs could be much reduced. To a less extent, perhaps, but still to a substantial degree, the cost of other animal products is increased by the ravages of disease on our flocks and herds.

It was the extent of these losses to the stock-owner, and their effect on the food supply of the public, that led the Agricultural Research Council, soon after it was established in 1931 and had surveyed the tasks confronting it, to decide that its main effort in the immediate future should aim at effecting an improvement in the health of farm animals.

With this object in view the Council formed technical committees which brought together for joint study those already engaged in the investigation of a number of diseases of special importance. It made grants for assisting research in numerous cases where additional funds were necessary. It employed trained surveyors to visit stock-raising districts in which diseases, especially those of an obscure kind, were prevalent, and in this way collected much fresh information on the incidence of disease. Experience gained in work of the kind pointed to the need for a central field station at which it would be possible to carry out investigations on selected diseases on a large scale and under farm conditions. For this purpose the Council has acquired an estate of about 1,500 acres, and this is being provided with laboratories, houses for the breeding of laboratory animals and isolated cattle sheds for accommodating animals under investigation.

The work of the Council on animals is paralleled by the assistance it provides for investigational work on farm crops. Committees of specialist workers have been set up, for example, on virus diseases, on plant diseases due to helminth attack and on insecticides and fungicides. One very active committee has been that on the Preservation of Grass and other Fodder Crops. Most of the special grants made by the

Council for work on crops are in aid of pathological investigations. Until 1911 very little attention was given to crop diseases in Great Britain, but when the Development Act provided funds, entomologists and mycologists were added to the staffs of most agricultural institutions and, as research workers or advisory officers, they have since given much-needed help to agriculture and horticulture; thus the increase in fruit growing and other forms of horticulture that has taken place in recent years has been stimulated by the researches of plant pathologists and, as in the case of animal products, the nutritional demands of the public are being successfully met because of the invaluable aid which the scientific worker is able to give to the producer. Some of the best examples of "Practice with Science" that the country can show to-day may be found in the orchards of Kent and other apple-growing counties.

So far I have referred to matters that engage the attention of the scientific worker, while agriculture follows what has been called "its natural lines"; but unhappily for us, our peaceful art must face the problems raised by war, and although opinions have been expressed, and expressed freely on the subject in recent months, it cannot be said that there is any agreement on the rôle that agriculture either should, or could, be expected to fill in the event of war. Recent discussions, and my own experience in attempting to increase home produce during the War of 1914-18, lead me, therefore, now to refer to the scientific workers' programme in connection with home food production.

In recent discussions on this subject, advocates of storage, of increased shipping for transport and of increased tillage for home production have all been heard, but too frequently as advocates of rival methods of providing supplies in war. It cannot be stated too strongly that these methods are in no sense rivals. All the aid that each can give would be wanted in a war of long duration. In the early stages of a war, stores would be of especial value, throughout the period of hostilities all the tonnage which could be made available for the carriage of human and animal foodstuffs would certainly be wanted, and in the later stages of a long war reliance might have to be placed largely on home supplies.

It may be accepted, I think, that in any emergency, while every effort would be made to maintain our normal diet, chief anxiety would be caused by the position of energy-supplying foods, in practice our breadstuffs. It was generally recognised during 1914-18 that the comparative absence of food difficulties then experienced was due to the circumstance that breadstuffs were not rationed.

In the pre-War years 1909-13 Great Britain was producing about 35 per cent. of its energy requirements; in 1918 the food production campaign succeeded in raising the home supply to about 42 per cent. Entering the War with home supplies that would have maintained us for 125 days, we produced in 1918 the equivalent of 155 days' normal needs. Because of lack of labour, machinery and implements the difficulties we faced were extreme. With the number of tractors now available, grassland could be broken up rapidly; but it is one thing to break up grassland and quite another thing to farm it properly, and it is the farming, rather than the breaking up, that calls for careful preparatory work.

But why break up grassland? That was the question asked in 1915 and 1916; it caused much controversy and will do so again.

The answer is that, of human food of the kind which we should chiefly want in war, other crops produce much more than grass. In "Food Production in War" I have given many figures in support of this opinion which I need not cite here: one general statement will suffice. In the years 1909-13 the soils of the United Kingdom maintained a population of about 15½ millions. I estimated that less than one-third of this total had been maintained by our 34 million acres of cultivated grassland (that is, had been provided with the million calories per person per annum necessary), and that more than two-thirds had been maintained by our 13 million acres under crops other than grass. Per 100 acres of land, 12 and 80 persons respectively had been provided for. These figures, though they relate to the energy value of foods only and not to other things which are essential in our diet, give a fairly correct idea of the relative importance of grass and other crops in providing war rations. The chief reason for the very low production shown by grass is that a large percentage of our grassland is of poor quality and is grazed by store cattle and sheep. For the average pasture grazed by dairy cows my figure was 41 persons maintained per 100 acres; well-managed grass carrying good cows might indeed provide the energy needs of 75 to 80 persons per 100 acres.

Our present systems of husbandry took form long before the aeroplane had to be reckoned with and they may be regarded as suitable for conditions that until recently existed, but I cannot agree that, as Europe now is, we should remain satisfied with methods of farming that, in war, would leave us dependent for some 65 per cent. of our food supply on imports. My personal view is that, for defence reasons, we must change to a more flexible method of farming than that which is now commonly followed, that we should adopt a system which under peace conditions would provide from 35 to 40 per cent. of our requirements and in an emergency would enable us rapidly to increase food production to a figure providing about half our annual needs. The change which, for defence reasons, I now advocate is that for which my predecessor argued at Cambridge on grounds of good farming, namely, a change over from permanent to temporary grass.

Sir George Stapledon advocated ley farming on an extensive scale. The adoption of this system would in his view improve the output of nearly all English cultivated grassland. For the purpose I suggest above, it would not be necessary to replace more than from four to five million acres of permanent grass by temporary leys. If, say, 4½ million acres were thus converted, Great Britain would then have 16½ million acres under arable cultivation as it had 50 years ago. About 40 per cent. of the cultivated area would still remain under permanent grass, so that, in selecting the area for conversion into temporary leys, a wide choice would be available.

The substitution of temporary for permanent grass need not, in itself, call for substantial changes in the character of the land's output. The grassland would, as Sir George Stapledon stated, carry more stock, and if stock were paying better than crops the main change in output under peace conditions would be an increase in livestock products. From the point of view of

war farming the advantages of temporary leys are obvious. The use of the plough and of other implements would be familiar to farmers cultivating temporary leys, but in many cases would be quite unfamiliar to those occupying only permanent grass. Tillage implements would be available on the farms on which they would be required in an emergency and the quality of the land itself for tillage purposes would be well known; thus, in an emergency, arrangements for corn growing could quickly and easily be made.

In spite of the advantages to both the country and the farmer which can be claimed for ley farming, it must be recognised that in England there are circumstances which strongly tend to check the spread of the system. Permanent grass growing is the well-established custom of the country; the change over from tillage to grass farming saved many from bankruptcy at the end of the nineteenth century, and since that time grazing has, on the whole, been a safer business than agriculture. Again, short of capital as farmers are, it would take a good deal of courage to expend £3 to £7 per acre in forming a temporary ley, even if arithmetic proved that a return of 10 to 20 per cent. on the outlay may be expected over a period of years. The confidence of farmers in the future has been undermined as a result of their experiences since the War of 1914-18, and much will depend on the extent to which confidence can be restored as a result of the Government's recent policy.

What is now called for is intensive research at a central station on the many questions that would arise in connection with the conversion of permanent into temporary grassland, together with a close study of local conditions, favourable and unfavourable for the extension of ley farming, by economists and other scientific workers in different parts of the country. Sir George Stapledon himself is at some pains to explain that he is not an economist; all the more need that we should put the economist on his tracks! He has already persuaded a number of farmers to adopt his advice, and the results secured by men who have successfully turned from permanent to temporary grass farming would be of much value. Relatively the number of men concerned may be small, but I believe that they are sufficiently numerous to provide us with guidance of a kind that we cannot afford to neglect.

There are, indeed, features in the present situation which suggest that there is much scope for the economist, and not only in connection with the interpretation of the experiences of grass growers. All readers of agricultural journals know that, in spite of agriculture's depressed state, there are within the industry many enterprising men who are doing well both for themselves and for their land. Their methods are certainly worth study and exposition, and the audience waits. Thanks to such movements as the Young Farmers' Clubs and to the facilities for training provided by farm institutes, there are now in Great Britain a large number of lads and young men keenly interested in agricultural progress and anxious to learn. Economic studies of the methods of successful men would be welcomed by these learners and by them would be translated into practice later on. The young farmers of my generation learned chiefly by example, and no doubt the young farmers of to-day continue to do so; but to-day, much more than formerly, they are so trained as to welcome precept, if precept is based on economic studies of the kind I have in view. Thus in the process of converting some four or five million acres now in permanent grass into temporary pastures, which would be necessary to fit England to respond rapidly, as Scotland already can, to the call for increased food supplies, I lay much stress on the assistance which the economist can give.

The awakening of the soil, which would follow the breaking up of permanent grassland, would intensify the programmes of most other scientific workers and in some cases would call for substantially increased activity. This would be the case especially in agricultural engineering. Whether in tilling a larger area in normal times, or in rapidly extending the tillage area in war, no form of aid would be more welcome to the farmer than aid in selecting and employing machines and implements that would enable him to use manual labour to advantage.

Many other matters would call for the attention of the scientific worker in war; some of them could be predicted because of 1914-18 experience, others could not, for one thing learned in 1914-18 was that war throws up new and unexpected problems. On the precise nature of these problems we need not now speculate; rather let us note that the scientific worker is confronted with one very definite objective. This objective, which must be approached from different angles, may, in a sentence, be stated to be the preparation of British agriculture to expand its normal output of food rapidly if called upon to do so. The immediate aim should be the provision of a six months' supply of food for the nation in an emergency.

Many of those who have considered the subject of food supply in war would not agree with the views I express; they would point to agricultural experience in recent years and argue that the production of half the nation's food from the soils of Great Britain would be impossible. But while I admit that experience since 1919 has not been encouraging, my view is that our present tendency is to underestimate the capacity of our agriculture, and I claim that our outlook should not be restricted by the experience of the past 20 years.

There is little amiss with the soils, or the climate, of Britain; our tillage land responded well to the calls made on it a century ago and would respond again. Our farmers taught those of most other countries, and if their pupils are now, in some cases, ahead of them, there is no lack of farming talent. Research and education in agriculture have been with us for a generation; growth may have been slow at first, but advances are now being made at a rate that is encouraging, and we may confidently expect much more aid from science in future than it has given us since 1919. Thus, from the technical point of view, I see no insuperable difficulties in the programme I have outlined.

From the point of view of farmers themselves, however, the case is otherwise. If they and their employees are to earn as meagre a share of the national income in future as they have done in the past 20 years, a further decline in the arable area is only too likely, for the reason that, under recent conditions, masters and men have lost confidence in their future prospects.

There is an atmosphere of "defeatism" about, and not only among agriculturists themselves. There is too ready an acceptance of the doctrine that economic changes have condemned the land of England to slumber under grass, and that economic reasons forbid its awakening by the plough. As matters are, it would certainly cost

the nation money to bring several millions of acres back into arable cultivation and to substitute temporary for permanent pastures; but if the change were made, not only would we add largely to the agricultural output, but also there is at least a prospect that farmers would find themselves better off than they now are. In my judgment the ease with which tolerably good grass can be grown in many parts of England has led far too many farmers to bury their talents under the green sod, and too many farmers, as well as their counsellors, believe that it is prudent to leave these talents buried; but looking to the future I am satisfied that good and faithful service to the country calls for a change, and, I hope, for a change that would be rewarded. To science I look for assistance in bringing this change about and, for the farmer's reward, to the belief that the world's non-agricultural inhabitants cannot expect a continuation of the conditions which, during the past century, have enabled them to buy their food at less than cost price. But these conditions may not quickly alter, while changes in farming are needed now, and as I have admitted that the nation must pay before large changes in our methods of cultivation can be expected, I will be asked: Why should the nation pay?

Whatever the next year or two may hold in store, Britain, hateful as the prospect may be, cannot afford to neglect preparations for defence. In these preparations agriculture must have a place. How large this place should be is a matter of opinion. My personal view, based on experience gained during 1914-18, is that it should have a large place; but be its place large or small, it is for services rendered in connection with defence that farmers can legitimately ask the nation to pay, as it is paying and paying heavily, for the services of others similarly engaged.

Thus looking to the future I conclude that the century-old motto which heads my paper is still applicable; the nation which relied on the British farmer for its food supply in 1839 cannot do without his aid in 1939; while he himself, if he is to do his part as his forefathers did, must take as his watchword "Practice with Science."

* * * * *

CANCER RESEARCH IN WAR-TIME

Lord Hailsham, presiding at the annual meeting of the British Empire Cancer Campaign, read a message sent by the Duke of Gloucester (president) who, writing from the Headquarters of the British Expeditionary Force, said: "It is encouraging to learn that important cancer research will continue to be carried out under the auspices of the campaign. I understand that those who are skilled in such research, and whose services are not required at this juncture for national scientific purposes, will continue to apply their efforts to the solution of the problem. The cessation of any medical research, and more especially cancer research, except in circumstances where the personnel was not available, would be deplorable. . . . Last year his Majesty's Government placed upon the Statute-book the Cancer Bill, which should bring much relief to sufferers from this illness, enabling them to obtain treatment in the earliest stages. We must remember, however, that the Bill does not provide for research into the causes and cure of cancer, and that the Minister of Health announced that the Government depended on our campaign and other organisations to continue and intensify their efforts to solve the cancer problem."

Lord Horder, in proposing the adoption of the annual report, said that the Duke of Gloucester's timely words about research gave a lead where a lead was much required. When war broke out there was a general move to close down voluntary efforts, however urgent. Second thoughts brought wisdom and it was realised to be a duty to continue research in matters affecting the health of the community, even during the stress and strain of war. This was a service to the country that could, to a considerable extent, be carried out by those who were by age precluded from making more immediate contributions to the service of the country.

Grants totalling £35,000 for cancer research during the year 1940 were made to institutions and independent workers.

Tars and other Agents

The annual report offers the suggestion that cancer-producing substances, such as some of the tars, exert their effects in conjunction with other agents, and in this connection the medical correspondent of *The Times* observes: "Tumours in fowls, for example, may be induced by tar; once induced they can be transmitted to other fowls without any use of tar. The tar, it would seem, can only be a factor in the induction; some other element must be present. It should be remembered that these fowl tumours contain a filterable virus and that this virus is the infective agent. The infectivity of the virus can in fact be increased by suitable means. Thus, it appears that fresh support has been forthcoming for the view of Dr. Gye—that a virus enters into the causation of tumours in conjunction with another element. A great deal of new work has been done in connection with the cancer-inducing substances, and it has been shown that these substances possess also a growth-restraining power—a somewhat surprising discovery. The meaning of the observations is still in considerable doubt, but it is obvious that an important fact has been discovered."

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NEW INTERNATIONAL STANDARDS

Prolactin and the Gonadotrophic Substance of Pregnant Mare's Serum

It was recently stated that the Third International Conference on the Standardisation of Hormones, held at Geneva in 1938, had decided that international standards should be established for certain hormones of the anterior lobe of the pituitary gland and analogous substances found in urine and serum, and that international units should be defined in terms of a weight of each such standard. It was further decided that the final preparation of these standards, their dispensing in a form suitable for the use of the laboratory worker, their storage, preservation and subsequent distribution should be undertaken by the National Institute for Medical Research, Hampstead, London. The first of these new standards, as announced earlier in the year, namely, that for the gonadotrophic substance of human urine of pregnancy—chorionic gonadotrophin—was established in May of this year.

The National Institute for Medical Research now announces that the preparation of two additional international standards has been completed, namely, for the gonadotrophic substance of pregnant mares' serum and for the lactogenic (crop-gland stimulating) substance of the anterior lobe of the pituitary gland. The former standard has been prepared from substantial amounts of material generously provided by five manufacturing firms in four different countries, and the latter from material supplied by seven manufacturing firms and two research institutes in five countries. Individual samples of each standard were examined by members of the Conference; a suitable mixture was made to serve as the respective international standard, and then dispensed in the form of tablets which have been packed in sealed tubes. For each standard, each tablet contains approximately 100 international units.

The international standard for the gonadotrophic substance of pregnant mares' serum is dispensed in the form of 25-mg. tablets, each sealed tube containing ten tablets, and the international unit has been defined as the specific gonadotrophic activity contained in 0·25 mg. of the standard preparation.

The international standard for prolactin is dispensed in the form of 10-mg. tablets, each sealed tube containing ten of the tablets, and the international unit has been defined as the specific activity contained in 0·1 mg. of the standard preparation.

As with international standards for other hormones, drugs and vitamins, the standards are held, on behalf of the Health Organisation of the League of Nations, at the National Institute for Medical Research, Hampstead, London, N.W.3, and are distributed therefrom to national control centres established in other countries for local distribution to laboratories, institutes and research workers, and to workers in other countries in which the establishment of national control centres has not yet been completed. Applications for supplies of the standards should be made to the Department of Biological Standards, the National Institute for Medical Research, Hampstead, London, N.W.3.

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CIRCULATION IN THE FOETUS

"While continuing their radiological studies of the ductus arteriosus with a greatly improved technical equipment, A. E. Barclay, Sir Joseph Barcroft, D. H. Barron, and K. J. Franklin were led to suspect their previous identification of this structure in the sheep foetus," states the *British Medical Journal* in a recent issue. "They have now shown that this suspicion was justified, for in their latest paper, they present conclusive evidence from three distinct types of experiment. The most spectacular experiment was the retrograde injection of radio-opaque medium, *via* the femoral artery, in a newborn lamb with a very feeble heart-beat. The medium, faced by so low a resistance, passed up the aorta to the aortic valve and from the aorta, through the ductus arteriosus, into the pulmonary trunk and pulmonary arteries. Individual frames from the direct X-ray cinematographic record of the injection show quite clearly the anatomical relations of the ductus to the two great vessels that it unites. It is to be noted that the ductus joins the aorta distal to the point of origin of the brachio-cephalic artery, which corresponds to the innominate and the left subclavian arteries of the human subject. Having identified the ductus beyond dispute, the authors of the paper proceeded to investigate the courses taken by the blood flowing along the superior vena cava, and from the umbilical vein along the inferior vena cava. They found that all the superior caval blood goes into the right ventricle; thence it passes, on the one hand, into the pulmonary arterial system and, on the other, through the ductus arteriosus into the descending aorta. In contradistinction to the superior caval flow the oxygenated blood coming up the inferior vena cava from the placenta has two pathways. The bulk of it goes through the foramen ovale to the left side of the heart and passes *via* the aortic valve into the aorta, whence it supplies, through the coronary arteries, the heart, and through the brachio-cephalic artery the brain. At the same time a small portion leaves the main stream in the right auricle and goes through the right ventricle to the pulmonary arterial system and, by way of the ductus arteriosus, to the descending aorta. The experiments described provide the first direct demonstration of the mammalian foetal circulation, and it is of interest to see how closely previous observers have approached to the actual facts by various indirect methods. The times taken for functional closure of the ductus arteriosus and foramen ovale are not given in detail, but may be expected to appear in a later paper. It is not without interest that this description of the foetal circulation and identification of the ductus arteriosus has been published in the same year as the first successful ligation of a patent ductus in the human being."

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The council of the Royal Dublin Society have decided to continue during 1940 the scheme inaugurated in 1939 by which premiums were awarded to brood mares at a number of agricultural shows throughout Ireland. They state that the premium has increased the number of entries of mares to at least four-fold, and many local secretaries have written saying that the premium made all the difference between success and failure of their show.

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At the annual meeting of the Lodden, Framingham and District Shire Horse Society, at Loddon (Norfolk) it was announced that owing to the withdrawal of Government grants the Society is compelled to suspend operations.